

Two early Famennian rhynchonellid species from the Pripyat' (Belarus) and Dnepr-Donets (Ukraine) Depressions

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Abstract

Two rhynchonellid species are described from the lower Famennian of the Pripyat' (SE Belarus) and Dnepr-Donets (NE Ukraine) Depressions: *Sphaeridiorhynchus kuzmichiensis* n. gen., n. sp. and *Iloerhynchus tichomirovi* (LYASHENKO, 1959). The former is the type species of a new genus. The latter, the knowledge of which has rested so far on the external characters of a single specimen, is described in detail and adequately illustrated.

Key-words: rhynchonellids - brachiopods - *Sphaeridiorhynchus* - *Iloerhynchus* - lower Famennian - Pripyat' - Dnepr-Donets

Résumé

Deux espèces rhynchonellides sont décrites dans le Famennien inférieur des Dépressions de la Pripiat (SE Belarus) et du Dnieper-Donetz (NE Ukraine): *Sphaeridiorhynchus kuzmichiensis* n. gen., n. sp. et *Iloerhynchus tichomirovi* (LIACHENKO, 1959). La première est l'espèce-type d'un genre nouveau, tandis que la seconde, dont la connaissance reposait jusqu'ici sur les caractères externes d'un unique spécimen, fait l'objet d'une description détaillée et d'une illustration adéquate.

Mots-clefs: Rhynchonellides - Brachiopodes - *Sphaeridiorhynchus* - *Iloerhynchus* - Famennien inférieur - Pripiat - Dnieper-Donetz

Introduction

The Pripyat' Depression in SE Belarus and the Dnepr-Donets Depression in Ukraine (Text-fig. 1) are still almost virgin territory as far as our knowledge of upper Frasnian and lower Famennian brachiopods is concerned. This could be considered as a normal state of affairs, since all the available material derives from bore-holes, the cores of which are not usually expected to contain a rich and well preserved macrofauna. In fact the reverse is true; brachiopods are abundant and generally in an excellent state of preservation. The scientific community has still not grasped this potential wealth of information. Its awareness was finally woken up when PUSHKIN devoted his attention (1986, 1990, 1995) to the study of the lower Famennian rhynchonellids of the Pripyat' Depression. These preliminary investigations need to be com-

pleted by a detailed and thorough study in order to make it possible to use these rhynchonellids, the major constituent of the fauna, for the establishment of a reliable regional zonation and for correlation with other regions. As far as the Dnepr-Donets Depression is concerned, the study of the lower Famennian rhynchonellids is even more urgent because our only knowledge is based on the mere mention of names, many questionable, in faunal lists.

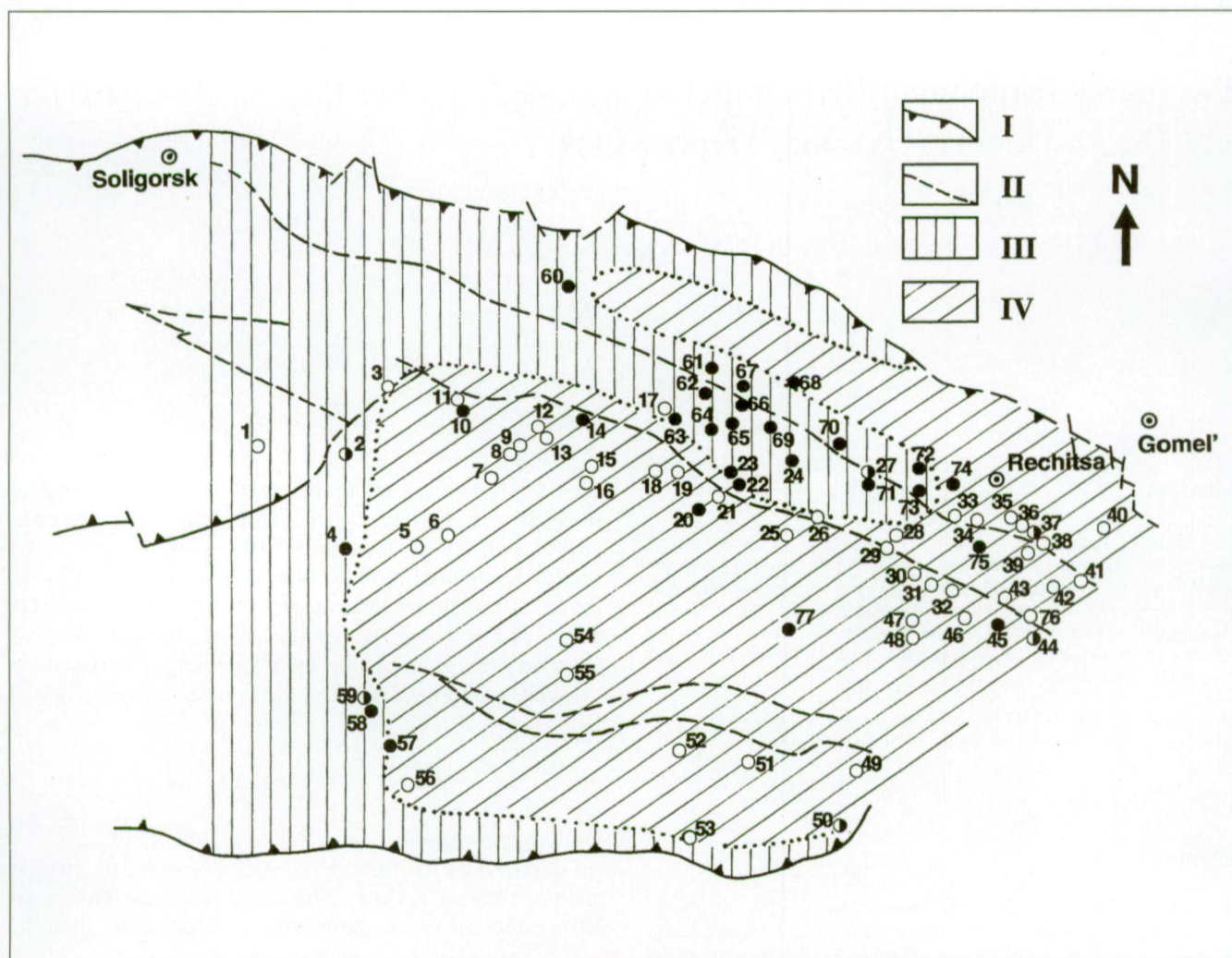
Sphaeridiorhynchus n. gen.

DERIVATIO NOMINIS

Τὸ σφαιρίδιον, ου (Greek, neuter) = marble; τὸ ρυγχος (Greek, neuter) = beak. The name has been chosen to draw attention to the characteristic shape of the shell.



Text-fig. 1 — Location of the Pripyat' (SE Belarus) and Dnepr-Donets (NE Ukraine) Depressions.

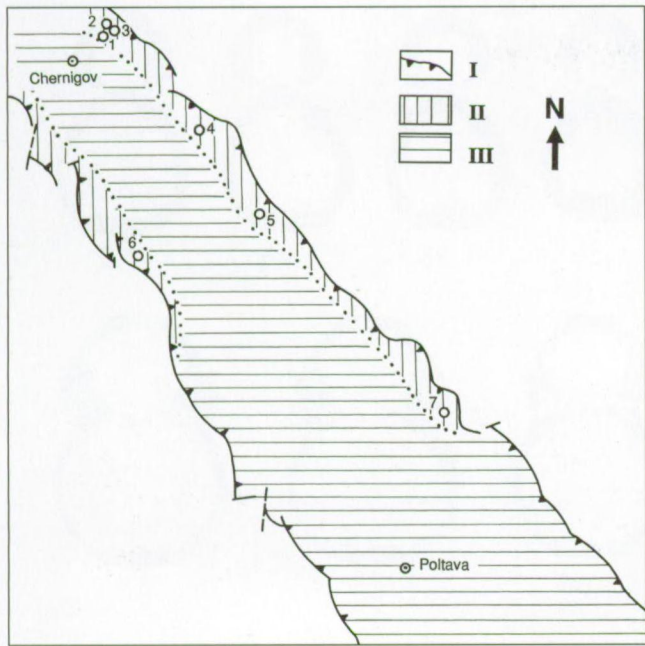


Text-fig. 2 — Boreholes from which the two species of the Pripyat' (SE Belarus) Depression described in the present paper have been retrieved.

1 - Lyakhovichi 54; 2 - Kuz'michi 1; 3 - East Vetchin 1; 4 - Petrikov 6; 5 - Petrikov (= Shestovichi) 2; 6 - North Skrygalovka 2; 7 - Kopatkevichi 5; 8 - West Bobrovichi 4; 9 - West Bobrovichi 1; 10 - Zarechenskaya 1; 11 - Chervonaya Sloboda 4; 12 - Komarovichi 2; 13 - Komarovichi 6; 14 - South Oktyabr' 6, 9; 15 - West Savichi 11; 16 - South Savichi 7; 17 - North Domanovichi 6; 18 - Novoselki 1; 19 - Tsidovo 1; 20 - Pritoki 14; 21 - Pritoki 13; 22 - North Pritoki 18; 23 - North Pritoki 19; 24 - West Zolotukha 1; 25 - Novinskaya 1; 26 - Zolotukha 4; 27 - South Tishkovka 48, 49; 28 - Malodusha 2; 29 - Malodusha 3; 30 - Malodusha 12; 31 - Malodusha 16; 32 - Barsuki 15; 33 - Rechitsa 12; 34 - Rechitsa 15; 35 - Dneprovo 12; 36 - Dneprovo 8; 37 - Dneprovo 20, 21, 22; 38 - Dneprovo 2; 39 - Krasnoe Selo 215; 40 - Borstchovo 1; 41 - Loev 3; 42 - Vetkhin 1; 43 - Nadvin 5; 44 - Yastrebovka 3; 45 - Vyshemir 3, 9; 46 - Kotel'niki 1; 47 - Omel'kovstchina 6; 48 - Omel'kovstchina 3; 49 - Strelichevo 6; 50 - Aravichi 1; 51 - East El'sk 15; 52 - El'sk 22; 53 - Rostcha 1; 54 - Kamenka 5; 55 - Gostov 1; 56 - West Valavsk 1; 57 - West Valavsk 2; 58 - Liplyanka 1; 59 - Liplyanka 2; 60 - Ozemlya 4; 61 - South Poless'e 35; 62 - South Davydovka 31; 63 - North Domanovichi 37; 64 - Novo-Korenevka 4; 65 - West Peretoki 1; 66 - Zimovstchina 1; 67 - Davydovka 7; 68 - Boroviki 3; 69 - South Sosnovka 53, Sosnovka 22; 70 - Ostashkovichi 7; 71 - South Tishkovka 43; 72 - Tishkovka 10; 73 - Tishkovka 1; 74 - Saltanovo 1; 75 - Rechitsa 104; 76 - Vyshemir 11; 77 - Khobno 1.

Hollow circles = *Iloerhynchus tichomirovi* (LYASHENKO, 1959). Black circles = *Sphaeridiorhynchus kuzmichiensis* n. gen., n. sp.

I = faults bounding the Pripyat' Depression; II = subsidiary faults connected with the distribution of facies; III = relatively shallow-water facies of the Tonezh and Tremlya Beds (limestones, metasomatic dolomites, sandstones); IV = relatively deep-water facies of the Tonezh and Tremlya Beds (marls and clays with layers of limestones, siltstones).



Text-fig. 3 — Boreholes from which the two species of the Dnepr-Donets (NE Ukraine) Depression described in the present paper have been retrieved. 1 - Gibova Rudnya 1; 2 - Lovin' 1; 3 - Lovin' 3; 4 - Sednev 2; 5 - Ushnya 1; 6 - Makarovo 1; 7 - Bugrevatovo 170. Hollow circles = *Iloerhynchus tichomirovi* (LYASHENKO, 1959). Black circles = *Sphaeridiorhynchus kuzmichiensis* n. gen., n. sp. I = faults bounding the Dnepr-Donets Depression; II = relatively shallow-water and relatively deep-water facies of the Kalaydintsy Formation (green limestones, marls and clays); III = deep-water facies of the Kalaydintsy Formation (dark marls, siltstones, argillites).

TYPE SPECIES
Sphaeridiorhynchus kuzmichiensis n. gen., n. sp.

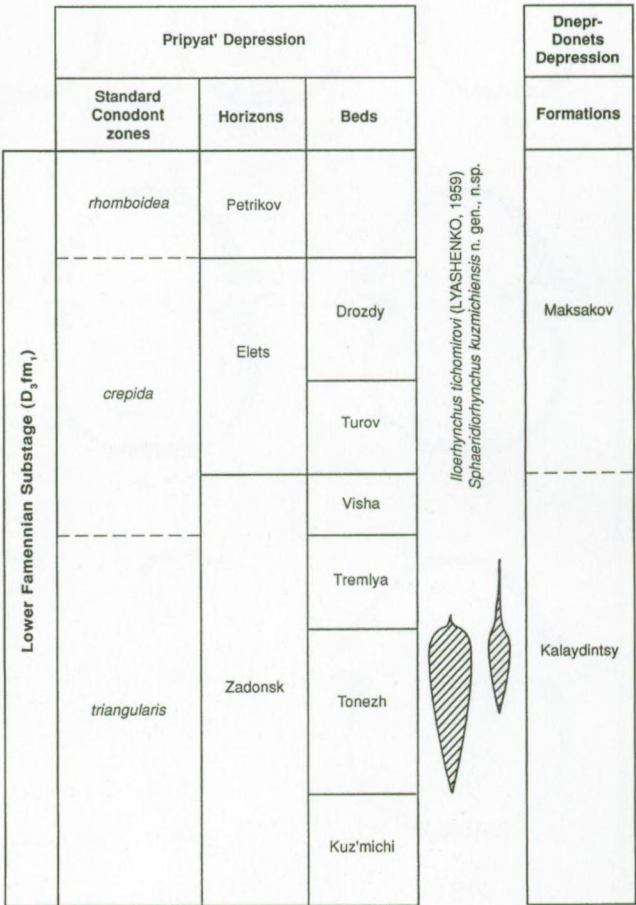
DIAGNOSTIC FEATURES
Small to medium-sized. Globular. Subcircular to transversely subelliptical. Sulcus and fold very low, wide at front, beginning at a variable but great distance from the beaks. Upper part of tongue often vertical or tending to become vertical. Extremely low and irregular median costae. Lateral costae absent. Wide apical angle. Maximum thickness of shell always posterior to frontal commissure. No dental plates, no septum, no septalium. Short divided hinge plate. Long crura.

SPECIES ATTRIBUTED TO THE GENUS
Only the type species is attributed to the genus.

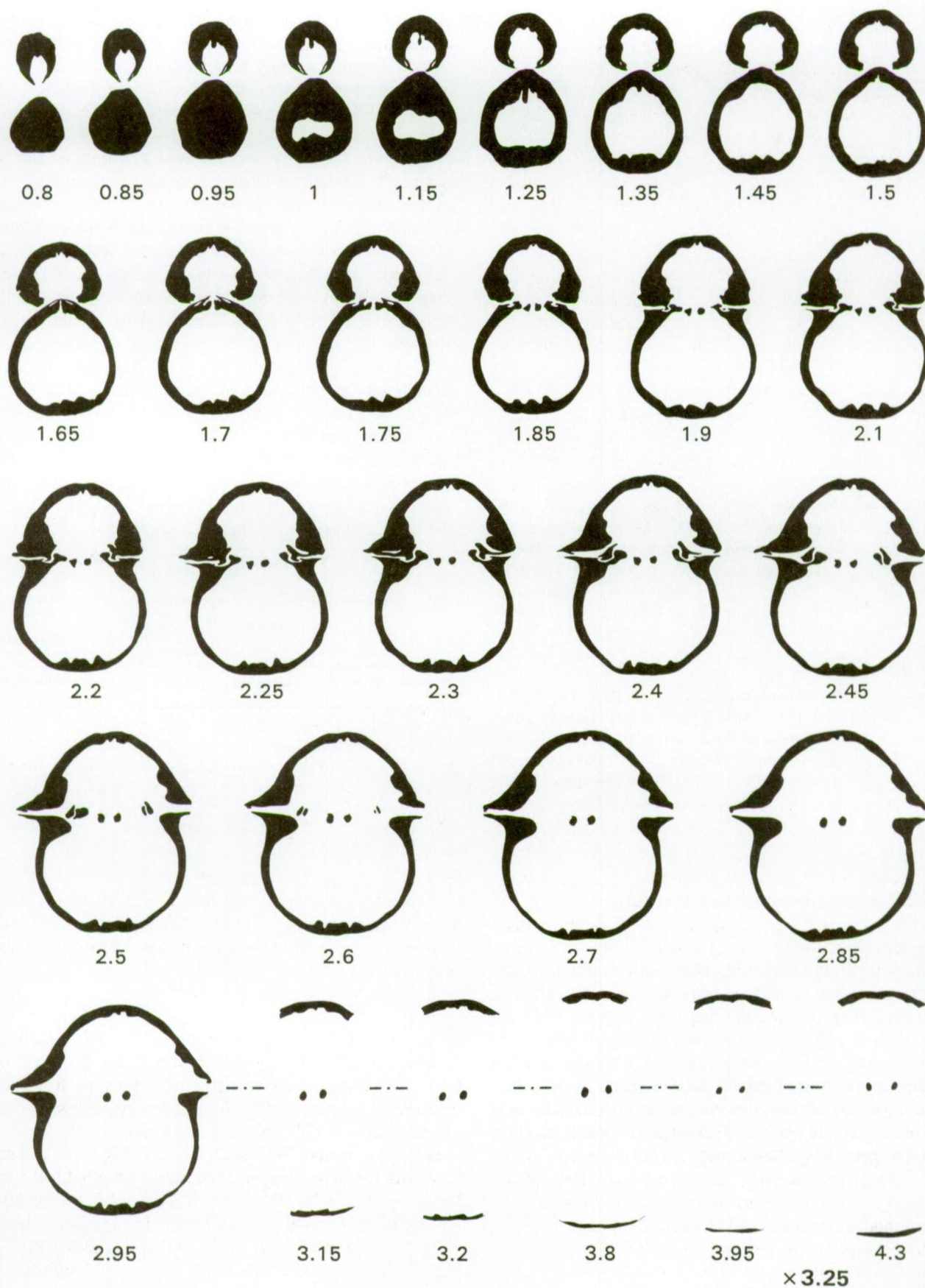
DESCRIPTION
Small to medium sized. General aspect globular. Dorsibiconvex, the thickness of the pedicle valve being about 33 to 45/100 of the thickness of the shell. Front margin uniplicate. Subcircular to transversely subelliptical in

ventral, dorsal, and cardinal views, the ellipse having a minor axis not much shorter than the major axis. Dorsal umbonal region usually tangential to the vertical plane, only exceptionally extending beyond the pedicle beak. Cardinal line short. Commissure sharp. Frontal commissure not undulated or, exceptionally, very slightly undulated by the low relief median costae, which usually do not reach the frontal commissure. Lateral commissures located high as seen in lateral profile. Postero-lateral margins concave near the commissure. Minute deltidial plates have been observed in transverse serial sections.

Contour of pedicle valve is half-circumference in longitudinal median sections and half-ellipse or half-circumference in transverse median sections. Flanks slope strongly. Sulcus wide at front, beginning imperceptibly at a variable but great distance from the beak, and separated from the flanks only by very low hog's-back ridges. Sulcus very low; the convexity of the bottom of the sulcus strengthens this character. Tongue trapezoidal, low to moderately high with sharp borders, standing out clearly. Upper part of tongue often vertical or tending to become vertical. The top of the tongue is never the highest part of the shell, but is situated below, sometimes much below,



Text-fig. 4 — Stratigraphic subdivisions of the lower Famennian of the Pripyat' (SE Belarus) and Dnepr-Donets (NE Ukraine) Depressions, and range of the two species described in the present paper.



Text-fig. 5 — *Sphaeridiorhynchus kuzmichiensis* n. gen., n. sp. Transverse serial sections; figures are distances in mm of the section forward of the crest of the ventral umbo. Paratype J, BelNIGRI 19/22-11, borehole Kuz'michi 1, Pripyat' Depression, depth 1338.3 m. Measurements: width 22 mm; thickness 17 mm.

the top of the shell. Beak small, wide, slightly incurved, overhanging the cardinal line, often almost in contact with the dorsal umbonal region. Beak resorbed by a small semi-circular foramen. Interarea short, low, ill-defined and partly concealed by the incurvation of the beak, and by the dorsal umbonal region.

Curve of the brachial valve is one quarter of the circumference in longitudinal median sections, and half the circumference in transverse median sections. Greatest thickness of brachial valve, and thus of the shell, located posterior to frontal commissure; from there the valve curves gently toward the commissure. Slope of flanks abrupt. Fold well marked in spite of its reduced height and the sphericity of the valve. Fold begins imperceptibly at some distance from the beak. Top of fold slightly convex.

Neither parietal nor lateral costae have been observed. Median costae extremely low, and sometimes nearly absent; it makes them difficult to count. They have irregular width, and divisions and intercalations are common; this results in an irregular pattern. Median costae start at variable distances from the beaks, but generally about level with the sulcus and fold; they rarely reach the frontal commissure. Costae are separated from each other by furrows of variable width. Variable and moderate number of median costae.

Greatest thickness of the shell located in the anterior part of the shell at a variable point posterior to the frontal commissure. Width and length have similar (sometimes identical) values. Maximum width of shell occurs around mid-length. Apical angle and angle of the cardinal commissure wide.

Shell thick in apical region. Dental plates and umbonal cavities absent. In transverse serial sections two or three very small chambers, separated by lamellar outgrowths of shell, are present in the extreme apical region; they follow one another in the slender part of the pedicle valve bordering the delthyrium. Small and short teeth. Contour of delthyrial cavity very irregular. Well developed denticula. Neither septum nor septalium. Very short divided hinge plate. Outer hinge plates and crural bases almost non-existent. Long crura remaining close to each other; they are oval to rounded in transverse serial sections. Dental sockets with low inner socket ridges.

COMPARISONS

The globular shape and the characteristically evanescent costation of *Sphaeridiorhynchus* n. gen. makes it an easily recognizable genus. Nevertheless, as *S. kuzmichiensis* n. gen., n. sp. has sometimes been named *Leiorhynchus* or "*Leiorhynchus*" aff. *tichomirovi* (see synonymy), some major differences between *Sphaeridiorhynchus* and *Iloerhynchus* BALIŃSKI, 1995 are given. *Sphaeridiorhynchus* n. gen. is distinct by: a larger size, a constantly globular aspect (*Iloerhynchus* is only sometimes globular), a completely different costation (median costae irregular, low, sometimes almost completely obliterated, in greater number), low sulcus and fold beginning at a great distance from the beaks, a somewhat

thicker shell in the apical region, and the absence of a septum and a septalium.

Sphaeridiorhynchus kuzmichiensis n. gen., n. sp.

Plate 1, Figures 1-47; Text-figure 5

Remark

The only difference between specimens of the new species from the Pripyat' and the Dnepr-Donets Depressions is that specimens of the former are sometimes somewhat larger. No weight is put on this difference, because it is not a major one, and also because the species was retrieved from a single borehole in the Dnepr-Donets Depression.

SYNONYMY

- 1969a *Leiorhynchus* aff. *tichomirovi* Ljasch. - LINNIK in LINNIK *et al.*, p. 18;
- 1969b *Leiorhynchus* aff. *tichomirovi* Ljasch. - LINNIK in LINNIK *et al.*, p. 20;
- 1974a *Leiorhynchus* aff. *tichomirovi* Ljasch. - LINNIK, p. 125;
- 1978 *Leiorhynchus* aff. *tichomirovi* Ljasch. - LINNIK in BELOUSOVA *et al.*, p. 195, table 15;
- 1981 "*Leiorhynchus*" aff. *tichomirovi* Ljasch. - PUSHKIN, p. 50;
- 1981 *Leiorhynchus* aff. *tichomirovi* Ljasch. - RAZNITSYN, p. 54, table, p. 62;
- 1990 *Caryorhynchus* aff. *tumidus* (Kayser) - Reshenie mez'vedomstvennogo regional'nogo stratigraficheskogo soveshchanya po srednemu i verkhnemu paleozoyu Russkoi platformy s regional'nymi stratigraficheskimi skhemami, Leningrad, 1988 g., Devonskaya sistema, lists 1 and 2;
- 1995 "*Brunnirhyncha*" *kuzmitchevensis* SARTENAER, PUSHKIN & KOTLYAR, 1995 - PUSHKIN in PUSHKIN *et al.*, table 3, p. 32, p. 46, fig. 13, p. 51, p. 52, fig. 15, p. 56, fig. 19, p. 69, p. 117.

DERIVATIO NOMINIS

Kuz'michi is a village in the Minsk area at 42 km SE of the town of Soligorsk in the Pripyat' Depression, Belarus. The largest collection of the species comes from the borehole Kuz'michi 1.

TYPES

The type series is deposited in the *Belorusskiy nauchno-issledovatel'skiy geologorazvedochny institut* (BelNIGRI) = Belorussian Geological Prospecting Research Institute, in Minsk, and in the Belgian royal Institute of natural Sciences (IRScNB), in Brussels.

Holotype, BelNIGRI 19/22-4 (Pl. 1, Figs. 1-5), borehole Kuz'michi 1, Pripyat' Depression, depth 1340.5 m. Paratype A, BelNIGRI 19/22-10 (Pl. 1, Figs. 16-20), borehole Kuz'michi 1, Pripyat' Depression, depth 1339.5 m. Paratype B, BelNIGRI 19/22-3 (Pl. 1, Figs. 21-24), borehole Kuz'michi 1, Pripyat' Depression, depth 1341 m. Paratype C, BelNIGRI 19/27-14 (Pl. 1, Figs. 11-15), borehole Yastrebovka 3, Pripyat' Depression, depth 1550 m. Paratype D, BelNIGRI 19/22-6 (Pl. 1, Figs. 6-10), borehole Kuz'michi 1, Pripyat' Depression,

depth 1331 m. Paratypes E, BelNIGRI 19/78-1 (Pl. 1, Figs. 34-38), F, IRScNB a10557 (Pl. 1, Figs. 39-43), G, IRScNB a10558 (Pl. 1, Figs. 25-29), H, IRScNB a10559 (Pl. 1, Figs. 44-47), I, BelNIGRI 19/78-2 (Pl. 1, Figs. 30-33), borehole Ushnya 1, Dnepr-Donets Depression, depth 2606 m. Paratype J, BelNIGRI 19/22-11 (Text-figure 5), borehole Kuz'michi 1, Pripyat' Depression, depth 1338.3 m.

Types from the Pripyat' Depression derive from the lower Famennian Tonezh Beds, those from the Dnepr-Donets Depression from the lower Famennian Kalaydintsy Suite.

A plaster cast of paratype J was made before grinding and is joined to the remainder of the specimen.

LOCUS TYPICUS

Borehole Kuz'michi 1, Pripyat' Depression, depth 1340.5 m.

STRATUM TYPICUM

Lower Famennian Tonezh Beds.

MATERIAL (Text-figures 2 and 3)

Four hundred and fifty-four specimens have been retrieved from the following boreholes in the Pripyat' Depression, SE Belarus (number of specimens in parentheses): Boroviki 3, depth 3808 m (10); Davydovka 7, depth 2991 m (2); Dneprovo 21, depth 2690 m (1); Khobno 1, depth 2835 m (2); Kuz'michi 1, depth 1321-1347.3 m (138); Liptyanka 1, depth 2202-2203 m (7); Liptyanka 2, depth 2107.5-2119.5 m (19); North Domanovichi 37, depth 2591-2594 m (16); North Domanovichi 41, depth 2423 m (3); North Pritoki 18, depth 3508.1 m (11); North Pritoki 19, depth 3488.3 m (6); Novo Korenevka 4, depth 2988-2991.8 m (32); Ostashkovichi 7, depth 2930 m (2); Ozemlya 4, depth 3504 m (1); Petrikov 6, depth 1463.7 m (2); Pritoki 14, depth 3816 m (1); Rechitsa 104, depth 4181-4184 m (64); Saltanovo 1, depth 2706 m (1); Sosnovka 22, depth 4095.6 m (1); South Davydovka 31, depth 3568.5 m (2); South Oktyabr' 6, depth 3810 m (2); South Oktyabr' 9, depth 3312 m (3); South Poless'e 35, depth 2884-2885 m (8); South Sosnovka 53, depth 4116 m (6); South Tishkovka 43, depth 4074.5-4074.6 m (11); South Tishkovka 49, depth 3844 m (4); Tishkovka 1, depth 2710 m (3); Tishkovka 10, depth 2665 m (2); Vyshemir 3, depth 2291-2293 m, 2331-2342 m (34); Vyshemir 11, depth 1937 m (14); West Peretoki 1, depth 3503-3507 m (23); West Valavsk 2, depth 3275 m (1); West Zolotukha 1, depth 3836 m (1); Yastrebovka 3, depth 1548-1550 m, 1602.5-1670 m (10); Zarechenskaya 1, depth 2880 m (9); Zimovstchina 1, depth 4053.8 m (2).

Eighty-nine specimens have been retrieved from a single borehole in the Dnepr-Donets Depression, NE Ukraine: Ushnya 1, depth 2604-2615 m.

DESCRIPTION

This refers only to generic characters in need of further detail

Sulcus beginning at 41 to 73 per cent of the shell length, mostly varying from 56 to 60 per cent, or 32 to 60 per cent of the unrolled length of the valve, mostly varying from 45 to 53 per cent. The sulcus starts with a width of 33 to 68 per cent of its width at the front and

reaches its greatest width (60 to 75 per cent of the shell-width, mostly varying from 60 to 68 per cent) at the junction of the frontal and lateral commissures. Top of tongue 25 to 32 per cent lower than point of maximum shell-thickness. Length of ventral interarea varying from 40 to 47 per cent of shell-width. Slight median depression sometimes present on the fold.

The general costal formula, which is a grouping of at least 75 per cent of the specimens in median, parietal and lateral categories, is $\frac{4-7}{3-6}$; 0; 0. Median costae were counted on 61 specimens: 0: 2 sp. (3.25%); $\frac{2}{1}$: 4 sp. (6.5%); $\frac{3}{2}$: 6 sp. (10%); $\frac{4}{3}$: 10 sp. (16%); $\frac{5}{4}$: 17 sp. (28%); $\frac{6}{5}$: 12 sp. (20%); $\frac{7}{6}$: 7 sp. (11.5%); $\frac{8}{7}$: 2 sp. (3.25%); $\frac{9}{8}$: 1 sp. (1.5%). Width of median costae at the

front usually varies from 2 to 3 mm, but may reach either 1 mm or 5 mm. On forty-one specimens on which such observations could be made, a furrow, narrower and deeper than the others can be seen on the fold of eight specimens and in the sulcus of four specimens. These furrows, half of them in a median position, look like slight cuts in the shell. In seven specimens a low and wide longitudinal swelling develops in the sulcus, not necessarily in the middle.

Measurements of the ten photographed specimens are given on Table 1. Columns 1, 3, 6, 7, 10 refer to specimens from the Pripyat' Depression, and columns 2, 4, 5, 8, 9 to specimens from the Dnepr-Donets Depression.

Top of pedicle valve located posteriorly at a variable point between 41 and 46 per cent of the shell-length, and top of brachial valve at a point varying between 48 and 58 per cent of the shell-length anterior to the ventral beak. Maximum width occurs between 49 and 59 per cent of shell-length anterior to ventral beak. Apical angle varying from 129° to 139° (mostly between 132° and 139°). Angle of the cardinal commissure varying from 134° to 150°.

Transverse serial sections of one specimen (paratype J) are shown in Text-figure 5

DISCUSSION OF SYNONYMY

See Discussion of synonymy of *Iloerhynchus tichomirovi* (LYASHENKO, 1959).

Geographical distribution and stratigraphical position of *Sphaeridiorhynchus* n. gen.

Sphaeridiorhynchus kuzmichiensis n. gen., n. sp. has been found in the upper half of the Tonezh Beds and the lower two thirds of the Tremlya Beds of lower Famennian age in the Pripyat' Depression of SE Belarus, and in the lower half of the Kalaydintsy Formation (= lowest Famennian formation) in the Chernigov region of the Dnepr-Donets Depression in NE Ukraine (Text-figs. 2-4).

Table 1

in mm	Paratype C	Paratype G	Holotype	Paratype I	Paratype E	Paratype D	Paratype B	Paratype F	Paratype H	Paratype A
l	20.6	19	18.9	18	17.6	17.5	16.2	15.5	14.5	13.6
w	20.3	20	23.7	18.7	18.6	20.1	17.4	17	18	16.4
lpv unrolled	31	30.5	32.5	24	26.5	31.5	25	(24.5)	23	20.5
t	16.4	16.1	18.7	15	13.8	17.1	14.6	13.8	12	14.4
tpv	7.3	6.2	6.8	8.5	6.1	7.1	5	5.8	7.5	5.7
tbv	9.1	9.9	11.9	6.5	7.7	10	9.6	8	4.5	8.7
l/w	1	0.95	0.80	0.96	0.95	0.87	0.93	0.92	0.81	0.83
t/w	0.81	0.81	0.79	0.80	0.74	0.85	0.84	0.82	0.67	0.88
t/l	0.80	0.85	0.99	0.83	0.78	0.98	0.90	0.89	0.83	1.05
apical angle	?	135°	139°	133°	132°	139°	135°	(133°)	134°	129°
angle of the commissure	?	141°	150°	140°	142°	148°	143°	?	141°	134°

l = length; t = thickness; w = width; bv = brachial valve; pv = pedicle valve. Measurements shown in parentheses indicate a reasonable estimate on a damaged specimen.

Few conodonts have been collected in both countries and their study is not completed yet. The available information points out to an age equivalent to the *Palma-tolepis triangularis* Zone, probably Early to Middle *P. triangularis* Zones.

***Ilorhynchus tichomirovi* (LYASHENKO, 1959)**

Plate 2, Figures 51-92, Text-figure 6

SYNONYMY

- 1959 *Liorhynchus tichomirovi* Ljaschenko (in litt.). - LYASHENKO, p. 93, p. 207, p. 228, table 4, pl. 76, figs. 9a,b,v,g,d;
 1965 *Leiorhynchus tichomirovi* Ljasch. - LINNIK, p. 17;
 1966 *Leiorhynchus tichomirovi* Ljasch.(1959) - LINNIK, p. 133;
 1966 *Liorhynchus tichomirovi* Ljasch. - TIKHOMIROV, pp. 149- 150;
 1967 *Leiorhynchus tichomirovi* Ljasch. - LYASHENKO, A.I. & G.P., p. 521;
 1968 *Leiorhynchus tichomirovi* Ljasch. - LINNIK in LINNIK et al., pp. 4-5;
 1968 *Leiorhynchus tichomirovi* Ljasch. - LINNIK, p. 11;
 1969 *Leiorhynchus? tichomirovi* Ljasch. - LINNIK, p. 18, p. 21;
 1969a *Leiorhynchus tichomirovi* Ljasch. - LINNIK in LINNIK et al., p. 18;
 1969b *Leiorhynchus tichomirovi* Ljasch. - LINNIK in LINNIK et al., p. 20;

- 1969 *Leiorhynchus tichomirovi* Ljasch. - LYASHENKO in LYASHENKO et al., p. 3, p. 5;
 1974 *Leiorhynchus* cf. *tichomirovi* Ljasch. - KHOMENKO & LYASHENKO, p. 124, table 6, p. 153;
 1974 *Leiorhynchus* ex gr. *tichomirovi* Ljasch. - BRITCHENKO et al., p. 212;
 1974a *Leiorhynchus tichomirovi* Ljasch. - LINNIK, p. 125, p. 126;
 1974b *Leiorhynchus tichomirovi* Ljasch. - LINNIK, p. 153;
 1975 *Leiorhynchus tichomirovi* Ljasch. - LINNIK in GOLUBTSOV et al., p. 45;
 1975 *Leiorhynchus tichomirovi* Ljasch. - KRUCHEK, p. 10;
 1978 *Leiorhynchus tichomirovi* - LINNIK in BELOUSOVA et al., p. 69, p. 195, table 15;
 1979 *Leiorhynchus tichomirovi* Ljasch. - KRUCHEK & NEKRYATA, p. 20;
 1979 *Leiorhynchus* ex gr. *tichomirovi* Ljasch. - KRUCHEK & NEKRYATA, p. 21;
 1981 *Leiorhynchus tichomirovi* Ljasch. - MAKHNACH et al., p. 25;
 1981 *Leiorhynchus* (*Eoparaphorhynchus*) *tichomirovi* Ljasch. - LINNIK, p. 78;
 1981 "*Leiorhynchus*" *tichomirovi* Ljasch. - PUSHKIN, p. 50;
 1982 *Leiorhynchus tichomirovi* - KOTLYAR, p. 82;
 1986 *Leiorhynchus* cf. *tichomirovi* Ljasch. - KHOMENKO, p. 37, table 2;
 1988 *Leiorhynchus lentiformis tichomirovi* Ljasch. - KOTLYAR in GORAK et al., p. 20;
 1988 *Eoparaphorhynchus lentiformis tichomirovi* - KOTLYAR in GORAK et al., table 1;

- 1990 *Caryorhynchus tichomirovi* (Ljasch.) - PUSHKIN, p. 1031, p. 1032, table, p. 1033;
 1990 "*Leiorhynchus*" *tichomirovi* Ljasch. - Reshenie ... Devonskaya sistema, list 1;
 1992 *Brunnirhyncha tichomirovi* (Ljasch.) - MAKHNACH *et al.*, p. 612, p. 613, p. 614;
 ? 1995 "*Leiorhynchus*" *tichomirovi* Ljasch. - RZHONSNIYSKAYA & FEDOROVA, table 3, p. 112;
 1995 *Brunnirhyncha tichomirovi* (Ljaschenko), "*Brunnirhyncha*" *tichomirovi* (Ljaschenko, 1959) - PUSHKIN *in* PUSHKIN *et al.*, table 1, p. 17, table 3, p. 32, fig. 8, p. 36, fig. 11, p. 44, p. 45, p. 46, p. 50, p. 52, fig. 15, p. 56, p. 116, p. 117;
 1996 "*Brunnirhyncha*" *tichomirovi* (LYASHENKO, 1959) - PUSHKIN, p. 47.

TYPES

LYASHENKO (1959, table 76, explanation of figure 9) indicated the borehole Starobin 54, depth 154-158 m as the *locus typicus* of the holotype, the only specimen at his disposal. This borehole is presently referred to as borehole Lyakhovich 54, Pripyat' Depression, Belarus (MAKHACH *et al.*, 1992).

The following topotype and hypotypes are deposited in the Belorusskiy nauchno-issledovatel'skiy geologorazvedochny institut (BelNIGRI) = Belorussian Geological Prospecting Research Institute, in Minsk, and in the Belgian royal Institute for natural Sciences (IRScNB), in Brussels..

Topotype, BelNIGRI 19/24-74 (Pl. 2, Figs. 53-56), borehole Lyakhovich 54, Pripyat' Depression, depth 159 m. Hypotype A, BelNIGRI 19/88-1 (Pl. 2, Figs. 48-52), borehole Kotel'niki 1, Pripyat' Depression, depth 2567 m. Hypotype B, BelNIGRI 19/37-2 (Pl. 2, Figs. 57-60), borehole Vyshemir 3, Pripyat' Depression, depth 2325 m. Hypotype C, BelNIGRI 19/87-5 (Pl. 2, Figs. 61-65), borehole Nadvin 5, Pripyat' Depression, depth 2532 m. Hypotype D, BelNIGRI 19/38-1 (Pl. 2, Figs. 66-69), borehole Novoselki 1, Pripyat' Depression, depth 3732 m. Hypotype E, BelNIGRI 19/48-3 (Pl. 2, Figs. 84-88), borehole Lovin' 1, Dnepr-Donets Depression, depth 1340 m. Hypotypes F, IRScNB a10560 (Pl. 2, Figs. 70-74), G, IRScNB a10561 (Pl. 2, Figs. 75-79), H, IRScNB a10562 (Pl. 2, Figs. 80-83), borehole Lovin' 3, Dnepr-Donets Depression, depth 1279.5-1284 m. Hypotype I, BelNIGRI 19/48-2 (Pl. 2, Figs. 89-92), borehole Lovin' 1, Dnepr-Donets Depression, depth 1365 m. Hypotype J, BelNIGRI 19/27-7 (Text-figure 6), borehole Yastrebovka 3, Pripyat' Depression, depth 1619.5 m.

Types from the Pripyat' Depression derive from the lower Famennian Tonezh Beds, those from the Dnepr-Donets Depression from the lower Famennian Kalaydinty Formation.

A plaster cast of hypotype J was made before grinding and is joined to the remainder of the specimen.

MATERIAL (Text-figures 2 and 3)

One thousand and fifty-seven specimens have been retrieved from the following boreholes in the Pripyat' Depression, SE Belarus (number of specimens in parentheses): Aravichi 1,

depth 3332-3333 m (20); Barsuki 15, depth 3290 m (15); Borstchovo 1, depth 2525 m (2); Chervonaya Sloboda 4, depth 2514-2522 m (20); Dneprovo 2, depth 2945 m (1); Dneprovo 8, depth 3030 m (1); Dneprovo 12, depth 3041-3064 m (27); Dneprovo 20, depth 3093 m (2); Dneprovo 22, depth 2950.5-2964.5 m (2); East El'sk 15, depth 3201 m (7); East Vetchin 1, depth 1755.2-1768 (14); El'sk 22, depth 2220 m (1); Gostov 1, depth 3350-3355 m (6); Kamenka 5, depth 3440.3-3444.6 m (3); Komarovichi 2, depth 3082.2-3049 m (26); Komarovichi 6, depth 2903.5-3123 m (9); Kopatkevichi 5, depth 2308 m (5); Kotel'niki 1, depth 2567-2571 m (87); Krasnoe Selo 215, depth 3855.6-3860.3 m (20); Kuz'michi 1, depth 1336.9-1339.3 m (26); Liplyanka 2, depth 2177.5-2119 m (11); Loev 3, depth 1674 m (11); Lyakhovich 54, depth 159-162 m (6); Malodusha 2, depth 3517 m (5); Malodusha 3, depth 4050 m (4); Malodusha 12, depth 3375 - 3392 m (20); Malodusha 16, depth 3596 m (9); Nadvin 5, depth 2532-2732 m (138); North Domnovichi 6, depth 2820 m (1); North Pritoki 18, depth 3515.6 m (9); North Pritoki 19, depth 3520.2 m (5); North Skrygalovka 2, depth 3379.6-3393.6 m (5); Novinka 1, depth 3572 m (1); Novoselki 1, depth 3730-3785 m (40); Omel'kovstchina 3, depth 2924 m (4); Omel'kovstchina 6, depth 2285 m (4); Petrikov (= Shestovich) 2, depth 2345 m (2); Pritoki 13, depth 2825.5 m (2); Pritoki 14, depth 2721.9-2729 m (6); Rechitsa 12, depth 2200 m (3); Rechitsa 15, depth 2160 m (3); Rostcha 1, depth 2545 m (3); South Oktyabr' 6, depth 3896.6 m (9); South Savichi 7, depth 2523 m (3); South Tishkovka 48, depth 3808-3809 m (14); Strelchevo 6, depth 1435 m (1); Tsidovo 1, depth 3425.8-3436.4 m (20); Vetkhin 1, depth 2315 m (3); Vyshemir 3, depth 2330-2355 m (41); Vyshemir 9, depth 1980 m (3); West Bobrovichi 1, depth 2410-2413 m (5); West Bobrovichi 4, depth 2496.5-2549.3 m (11); West Savichi 11, depth 2736-2744 m (10); West Valavsk 1, depth 3845.5-3851 m (28); Yastrebovka 3, depth 1602.5-1670 m (306); Zolotukha 4, depth 2423 m (19).

Two hundred and seventy-five specimens have been retrieved from the following boreholes in the Dnepr-Donets Depression, northeastern Ukraine: Bugrevatovo 170, depth 3333-3345 m (20); Gribova Rudnya 1, depth 2676.5 m (3); Lovin' 1, depth 1333-1365 m (145); Lovin' 3, depth 1280-1341.2 m (70); Makarovo 1, depth 3261.5-3266.3 m (24); Sednev 2, depth 2870.2 m (5); Ushnya 1, depth 2604-2620 m (8).

DESCRIPTION

Remarks

Although LYASHENKO's (1959) original description of the species as *Liorhynchus tichomirovi* is on the whole satisfactory, it is based only on the external features of a single specimen; therefore, a new and more complete description is given. The generic assignment of the species was considered unsatisfactory by LINNIK (1974b, p. 153), who indicated that it was probably a representative of a new genus, but she did not follow up this statement. The genus *Iloorhynchus* BALIŃSKI, 1995, with the early Famennian *I. mesoplicatus* BALIŃSKI, 1995 from the Dębnik area (near Cracow, southern Poland) as the type and only species, accommodates the species here described.

Small to medium-sized. General aspect variable on account of convexity of valves and height of shell varying from moderate to noticeable; in the latter case the shell is

globular. In the only borehole, Yastrebovka 3, where the species has been retrieved from core-samples on a significant thickness (1602.5 to 1670 m), changes in convexity and height correspond to an evolution in time, the oldest representatives of the species being the lowest and the smallest. Dorsibiconvex, the thickness of the pedicle valve being 28 to 47 per cent of the thickness of the shell. Front margin uniplicate. Subcircular (generally) to transversely subelliptical in ventral and dorsal views. Subelliptical to subcircular (in high specimens) in apical view. Cardinal line short. Commissure sharp. Frontal commissure clearly indented by the median costae. Lateral commissure located high as seen in lateral profiles. Posterolateral margins concave near the commissure. Small deltidial plates have been observed in serial transverse sections.

Pedicle valve evenly convex. Contour of pedicle valve is half-ellipse or half-circumference in longitudinal median sections and half-ellipse in transverse median sections. Sulcus well marked, clearly separated from flanks, beginning at 12 to 33 per cent of the shell-length, most of the values varying from 20 to 33 per cent, or 13 to 34 per cent of the unrolled length of the valve, mostly varying from 18 to 22 per cent; when the shell is high the sulcus begins at a greater distance from the beak. The sulcus reaches its greatest width (66 to 84 per cent of the shell-width, mostly varying from 66 to 76 per cent) at the junction of the frontal and lateral commissures. Sulcus moderately deep to low, with flat to slightly convex bottom, bordered by two low rounded crests disappearing in the umbonal region; in globular specimens the sulcus is always low and its bottom convex. Tongue trapezoidal, low to high with sharp borders, standing out clearly. Upper part of tongue seldom vertical, and exceptionally recurved posteriorly. The top of the tongue is never the highest part of the shell, but is located 14 to 27 per cent lower than the point of maximum shell-thickness. Beak small, robust, erect to strongly incurved, overhanging the cardinal line, only sometimes almost in contact with the dorsal umbonal region in high specimens. Beak resorbed by a very small semi-circular foramen. Interarea short, low and well defined; its length varies from 35 to 48 per cent of the shell-width.

Curve of the brachial valve in longitudinal median sections varies from one quarter of an ellipse in the majority of specimens to one quarter of a circumference in high specimens. Greatest thickness of brachial valve, and thus of the shell, located posterior to frontal commissure; from there the valve curves gently toward the commissure. Slope of flanks usually strongly convex to steep, but abrupt in high specimens. Fold well marked, moderately high, beginning in the umbonal region. Top of fold flat, exceptionally slightly convex.

The general costal formula, which is a grouping of at least 75 per cent of the specimens in median, parietal, and lateral categories, is $\frac{3-4}{2-3}; 0; 0$. Median costae were counted on 522 specimens: $\frac{2}{1}$: 15 sp. (2.9%); $\frac{2}{2}$: 1 sp.

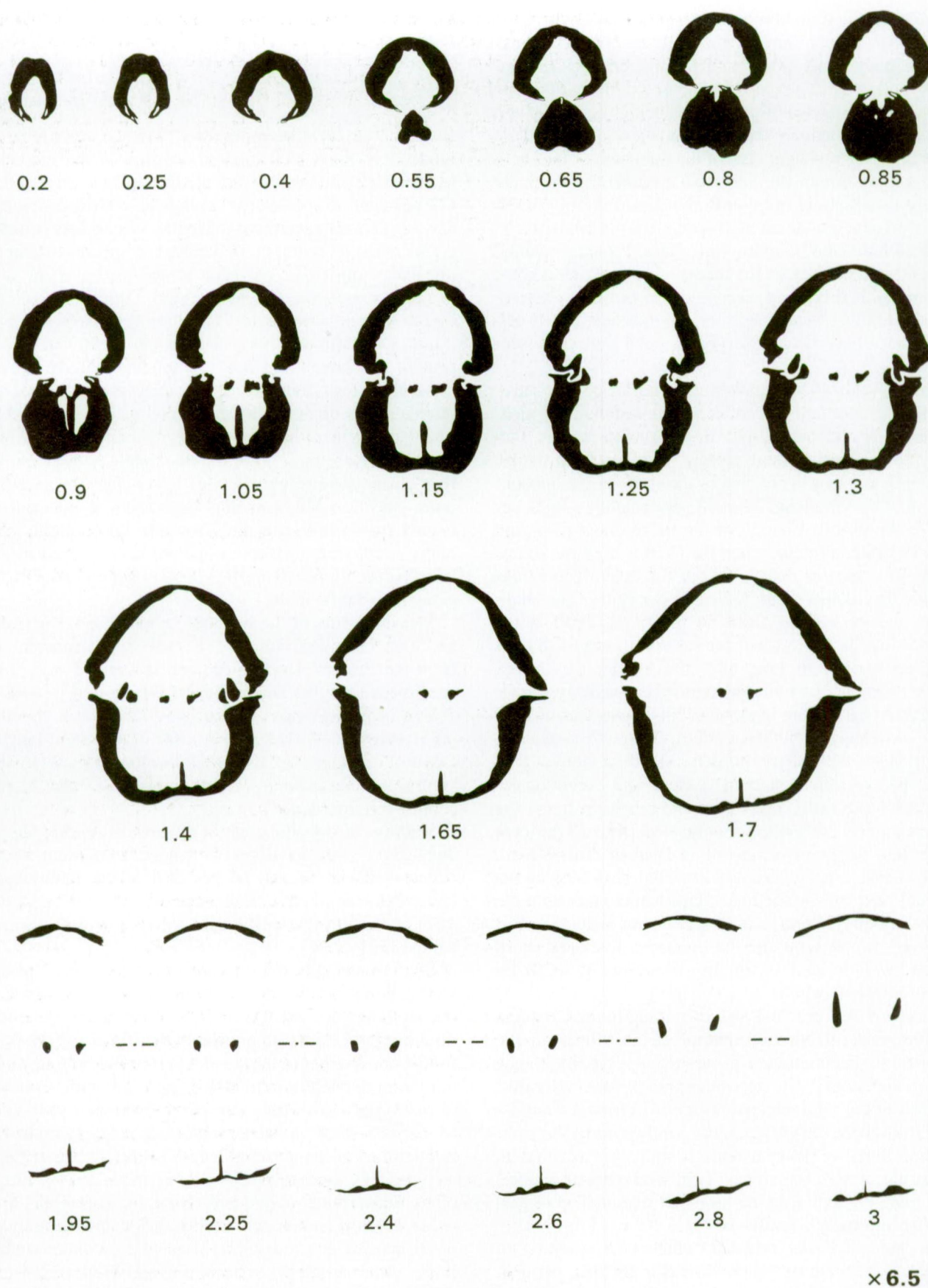
(0.2%); $\frac{3}{2}$: 278 sp. (53%); $\frac{3}{3}$: 14 sp. (2.7%); $\frac{4}{3}$: 161 sp. (31%); $\frac{4}{4}$: 1 sp. (0.2%); $\frac{5}{4}$: 47 sp. (9%); $\frac{5}{5}$: 1 sp. (0.2%); $\frac{6}{5}$: 3 sp. (0.6%); $\frac{7}{6}$: 1 sp. (0.2%). Neither parietal nor lateral costae have been observed. Median costae low to moderately high, well marked, starting in the umbonal region at some distance from the beaks; they are rounded (71 per cent of specimens) to angular with rounded top (29 per cent of specimens). Median costae and furrows are of subequal width in 58 per cent of specimens and of unequal width in 42 per cent of specimens, with, as a result, a regular or irregular pattern. Width of median costae at front varies from 1 to 3 mm, usually from 1.5 to 2 mm. Divisions and intercalations are present in 26 per cent of specimens, but only 10 specimens have shown more than one division or one intercalation. Most of intercalations do not reach the frontal margin. In the fold of 39 per cent of specimens the median costae (when three costae are present) or the two median costae (when four costae are present) is (are) lower than the external ones, causing a slight median depression. In one out of twenty specimens a thin and short adventitious costa, generally occupying a median position, is developed in the middle third of the sulcus; this costa is not included in the general costal formula.

Measurements of the ten photographed specimens are given on Table 2. Columns 1-3, 7, 10 refer to specimens from the Pripyat' Depression, and columns 4-6, 8, 9 to specimens from the Dnepr-Donets Depression.

Top of pedicle valve located posteriorly at a variable point between 34 and 54 per cent of the shell-length. Greatest thickness of the shell located anterior to the ventral beak at a point varying between 47 and 72 per cent of the shell-length.

Width is always the greatest dimension. Width, length and height often have similar values. Maximum width occurs between 51 and 66 per cent of the shell-length anterior to the ventral beak. Apical angle varying from 127° to 134°. Angle of the cardinal commissure varying from 133° to 138°.

Shell moderately thick in apical region. Dental plates and umbonal cavities absent. In transverse serial sections one to three very small chambers, separated by lamellar outgrowths of shell, are present in the apical region; they follow one another in the slender part of the pedicle valve bordering the delthyrium. Small and short teeth. Contour of delthyrial cavity irregular. Well developed denticula. Moderately thick and short septum; it may extend as far as one-third of the unrolled length of the shell, and thins and shortens anteriorly. Strong and short divided hinge plate. Outer hinge plates and crural bases considerably reduced. Short, moderately deep and U-shaped septalium. Short, narrow and low dental sockets. Low inner socket ridges. Stout crural bases becoming early separated from the outer hinge plates. Short crura, oval in transverse serial sections, and slightly incurved at their distal end. Transverse serial sections of one specimen (hypotype J) are shown in Text-figure 6.



Text-fig. 6 — *Iloerhynchus tichomirovi* (LYASHENKO, 1959). Transverse serial sections; figures are distances in mm of the section forward of the crest of the ventral umbo. Hypotype J, BelNIGRI 19/27-7, borehole Yastrebovka 3, Pripjat Depression, depth 1619.5 m. Measurements: length = 15.2 mm; width = 16.4 mm; thickness = 10.7 mm.

Table 2

in mm	Hypotype A	Hypotype B	Topotype	Hypotype H	Hypotype F	Hypotype I	Hypotype C	Hypotype G	Hypotype E	Hypotype D
l	14.9	13.9	13.8	13.6	13.5	13.3	12.9	12.8	12.8	11.8
w	16.4	15.9	18	15.2	16.8	14.5	15.4	15.9	15.3	12.9
lpv unrolled	22.5	19.5	23.5	19	22	19	20	20	19	14.5
t	12.2	11.3	12.3	(9.6)	12	10	12.3	11.9	10.5	7.6
tpv	5.7	5.2	5.3	?	4.6	3.6	3.5	3.7	3.7	3.2
tbv	6.5	6.1	7	?	7.4	6.4	8.8	8.2	6.8	4.4
l/w	0.91	0.87	0.77	0.89	0.80	0.92	0.84	0.81	0.84	0.91
t/w	0.74	0.71	0.68	(0.63)	0.71	0.69	0.80	0.75	0.69	0.59
t/l	0.82	0.81	0.89	(0.71)	0.89	0.75	0.95	0.93	0.82	0.64
apical angle	132°	134°	127°	?	133°	128°	?	134°	128°	130°
angle of the commissure	?	138°	134°	?	137°	133°	?	138°	134°	135°

l = length; t = thickness; w = width; bv = brachial valve; pv = pedicle valve. Measurements shown in parentheses indicate a reasonable estimate on a damaged specimen.

DISCUSSION OF SYNONYMY

The collections to which the names of the synonymy list relate either do not exist or are unavailable. It is fair to assume that most citations, if not all, concern *Iloerhynchus tichomirovi*, but obviously some of them - more particularly those referred to as ex gr., cf. and? - also include *Sphaeridiorhynchus kuzmichiensis* n. gen., n. sp., described in the present paper as a separate taxon. In fact (see Geographical distribution and stratigraphical position of the genus *Iloerhynchus*), the two species partly overlap in the upper half of the Tonezh Beds and in the lowermost Tremlya Beds. References aff. apply to specimens of *Sphaeridiorhynchus kuzmichiensis*, because LINNIK (personal communication) called them that in various publications (in LINNIK *et al.*, 1969a, b; 1974a; in BELOUSOVA *et al.*, 1978a) as did provisionally one of the authors (V.P., 1981). The reference *Leiorhynchus* aff. *tichomirovi* by RAZNITSYN also most probably indicates *Sphaeridiorhynchus kuzmichiensis*.

COMPARISONS

Not too much importance should be given to the statement by TIKHOMIROV (1966, pp. 149-150) that "*Liorhynchus tichomirovi* Ljasch. was to a certain degree similar to *Liorhynchus pavlovi* Müfke". We know now that these species belong to easily separable genera: *Iloerhynchus* and *Stenometoporphynchus* SARTENAER, 1987.

The genus *Iloerhynchus* BALIŃSKI, 1995 and its type species, *I. mesoplicatus* BALIŃSKI, 1995 have been clearly defined. BALIŃSKI (1995, p. 47, p. 48) compared these

taxa with genera and species sharing some common characters. More details are given here on the differences and similarities between *Iloerhynchus* and two genera of similar age that the authors consider the closest to it.

Brunnirhyncha HAVLÍČEK, 1979, which is of lower Famennian age according to the founder of the genus, and *Iloerhynchus* have many external and internal characters in common, e.g.: size, contour in ventral and dorsal views, short cardinal line, well marked sulcus and fold, trapezoidal tongue, short ventral interarea, greatest thickness of shell located posterior to frontal commissure, absence of lateral and parietal costae, strong and short hinge plate, short crura (oval in transverse serial sections), and absence of dental plates. *Iloerhynchus* can easily be separated by: a variable aspect related to the variable height; the fold, the sulcus and the rounded crests bordering it beginning a short distance from the beaks; a higher number of median costae, starting closer to the beaks, and generally better marked; surface never smooth; and the presence of a septum.

The lowermost Famennian genus *Orbiculatisinuostrium* SARTENAER, 1984 also has external and internal characters in common with *Iloerhynchus*, e.g.: size, contour in ventral and dorsal views, short cardinal line, well marked sulcus and fold, trapezoidal tongue, greatest thickness of shell located posterior to frontal commissure, and the presence of a septum. The genus *Orbiculatisinuostrium* is distinct from *Iloerhynchus* in having: sulcus and fold starting still nearer to the beaks; costation (occasional presence of lateral costae; finer median costae, usually in larger number, and starting nearer to the

beaks); a thicker shell in the apical region; the occasional presence of residual dental plates; a thinner septum; and a thinner hinge plate.

The more variable aspect connected with a more variable convexity of the valves and a more variable thickness of the shell make *I. tichomirovi* easily separable from *I. mesoplicatus*. Moreover, in *I. tichomirovi* costae are more often rounded than angular with rounded top, specimens commonly reach a higher size, and the general costal formula is slightly different (lateral costae are completely absent; number of costae may be higher).

Geographical distribution and stratigraphical position of the genus *Iloerhynchus*

LYASHENKO (1959, table 76, explanation of figure 9) indicated that the core-samples of depth 154-158 m in the borehole Starobin 54 (now borehole Lyakhovich 54) in the Pripyat' Depression of SE Belarus, from which the holotype of *Iloerhynchus tichomirovi* was retrieved, belonged to the early Famennian Zadonsk Horizon D₃² zad (?). The importance of the species for correlation within the Pripyat' Depression was stressed by BELOUSOVA *et al.* (1978, p. 69), who considered it as a zonal species. KOTLYAR (in GORAK *et al.*, 1988, p. 20, table 1) defined a *Cyrtospirifer ljachovichensis* - *Leiorhynchus lentiformis tichomirovi* lone (or *Cyrtospirifer ljachovitschensis* - *Eoparaphorhynchus lentiformis tichomirovi* regional

zone). Finally, PUSHKIN (1990, p. 1031, table, p. 1032, p. 1033; in PUSHKIN *et al.*, 1995, table 1, p. 17, p. 46, p. 50, p. 116, p. 117) established a biozone, a zone, and a community based on *Iloerhynchus tichomirovi*, and he gave as the range for the species the Tonezh Beds and the basal Tremlya Beds of lower Famennian age.

In the Chernigov and Poltava regions of the Dnepr-Donets Depression in NE Ukraine, *I. tichomirovi* is found in the lower half of the Kalaydinty Formation, i.e. in the lower half of the lowest formation of the Famennian (Text-figs. 2-4).

As stated before, few conodonts have been collected in both countries, and their study is not yet complete. The available information points to an age equivalent to the *Palmatolepis triangularis* Zone, probably the Early to Middle *P. triangularis* Zones.

As far as the type species of the genus *Iloerhynchus* is concerned, BALIŃSKI (1995, p. 3, p. 7, p. 8, fig. 3, p. 14, p. 15, table 1, p. 17, fig. 4, p. 21, p. 26, pp. 47-48, p. 51) recognized an *I. mesoplicatus* interval corresponding, in terms of the conodont succession, to the *Palmatolepis triangularis* Zone (probably lower part), but certainly not the lowermost part.

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Explanation of Plates

PLATE I

Sphaeridiorhynchus kuzmichiensis n. gen., n. sp.

All figures are natural size

Figs. 1-5 — Holotype, BelNIGRI 19/22-4, borehole Kuz'michi 1, Pripyat' Depression, depth 1340.5 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{5}{4}$; 0; 0.

Figs. 6-10 — Paratype D, BelNIGRI 19/22-6, same borehole, depth 1331 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{6}{5}$; 0; 0.

Figs. 11-15 — Paratype C, BelNIGRI 19/27-14, borehole Yastrebovka 3, Pripyat' Depression, depth 1550 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{6}{5}$; 0; 0.

Figs. 16-20 — Paratype A, BelNIGRI 19/22-10, borehole Kuz'michi 1, Pripyat' Depression, depth 1339.5 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{6}{5}$; 0; 0.

- Figs. 21-24 — Paratype B, BelNIGRI 19/22-3, same borehole, depth 1341 m. Ventral, dorsal, frontal and lateral views. Costal formula: $\frac{5}{4}$; 0; 0.
- Figs. 25-29 — Paratype G, IRScNB a10558, borehole Ushnya 1, Dnepr-Donets Depression, depth 2606 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{4?}{3}$; 0; 0.
- Figs. 30-33 — Paratype I, BelNIGRI 19/78-2, same borehole, same depth. Ventral, dorsal, apical and lateral views. Costal formula: $\frac{5}{4}$; 0; 0.
- Figs. 34-38 — Paratype E, BelNIGRI 19/78-1, same borehole, same depth. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{2}{1}$; 0; 0.
- Figs. 39-43 — Paratype F, IRScNB a10557, same borehole, same depth. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{3?}{2?}$; 0; 0.
- Figs. 44-47 — Paratype H, IRScNB a10559, same borehole, same depth. Dorsal, lateral, frontal, and apical views. Costal formula: $\frac{5}{4}$; 0; 0.

PLATE 2

Iloerhynchus tichomirovi (LYASHENKO, 1959)

All figures are natural size

- Figs. 48-52 — Hypotype A, BelNIGRI 19/88-1, borehole Kotel'niki 1, Pripyat' Depression, depth 2567 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{4}{4}$; 0; 0.
- Figs. 53-56 — Topotype, BelNIGRI 19/24-74, borehole Lyakhovichi 54, Pripyat' Depression, depth 159 m. Dorsal, frontal, apical and lateral views. Costal formula: $\frac{3}{3}$; 0; 0.
- Figs. 57-60 — Hypotype B, BelNIGRI 19/37-2, borehole Vyshemir 3, Pripyat' Depression, depth 2325 m. Dorsal, frontal, apical and lateral views. Costal formula: $\frac{4}{3}$; 0; 0.
- Figs. 61-65 — Hypotype C, BelNIGRI 19/87-5, borehole Nadvin 5, Pripyat' Depression, depth 2532 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{4}{3}$; 0; 0.
- Figs. 66-69 — Hypotype D, BelNIGRI 19/38-1, borehole Novoselki 1, Pripyat' Depression, depth 3732 m. Ventral, frontal, apical and lateral views. Costal formula: $\frac{3}{2}$; 0; 0.
- Figs. 70-74 — Hypotype F, IRScNB a10560, borehole Lovin' 3, Dnepr-Donets Depression, depth 1279.5-1284 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{3}{2}$; 0; 0.
- Figs. 75-79 — Hypotype G, IRScNB a10561, same borehole, same depth. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{3}{3}$; 0; 0.
- Figs. 80-83 — Hypotype H, IRScNB a10562, same borehole, same depth. Ventral, dorsal, apical and lateral views. Costal formula: $\frac{3}{2}$; 0; 0.
- Figs. 84-88 — Hypotype E, BelNIGRI 19/48-3, borehole Lovin' 1, Dnepr-Donets Depression, depth 1340 m. Ventral, dorsal, frontal, apical and lateral views. Costal formula: $\frac{4}{3}$; 0; 0.
- Figs. 89-92 — Hypotype I, BelNIGRI 19/48-2, same borehole, depth 1365 m. Ventral, dorsal, frontal and lateral views. Costal formula: $\frac{3}{2}$; 0; 0.

Plate 1

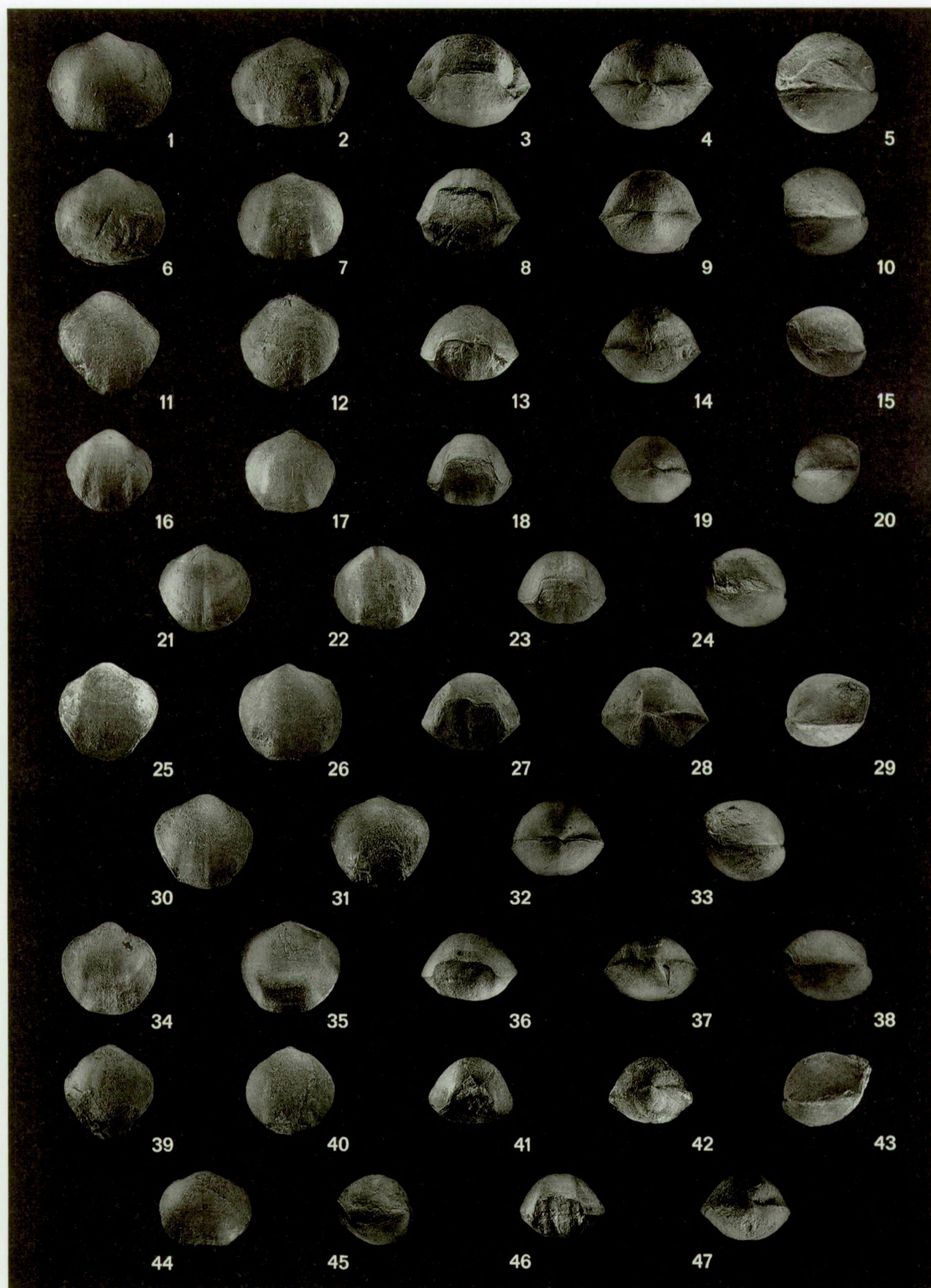


Plate 2

